W. B. No. 449.

U. S. DEPARTMENT OF AGRICULTURE,
WEATHER BUREAU.

BULLETIN V.

FROST DATA OF THE UNITED STATES;

AND LENGTH OF THE CROP-GROWING SEASON, AS DETERMINED FROM THE AVERAGE OF THE LATEST AND EARLIEST DATES OF KILLING FROST.

By P. C. DAY, Chief of Climatological Division.

Prepared under the direction of WILLIS L. MOORE, Chief of Weather Bureau.

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FROST DATA AND LENGTH OF THE CROP-GROWING SEASON.

SOURCE OF DATA.

The tabulation of statistics regarding the occurrence of frosts in the United States has in the past been confined in the main to the data collected at the regular telegraphic reporting stations of the Weather Bureau, something like 150 in number, with substantially continuous records, located principally in the larger cities and towns.

On account of the many agencies operating in the cities that directly affect the local conditions, especially as to temperature and the occurrence of frost, it is clear that the records from these points do not represent the real conditions that prevail in the open country where the staple crops are grown.

To secure data that would show more nearly the actual conditions that prevail in the fields, orchards and gardens, the most extensive compilation of frost data yet undertaken by the Weather Bureau has been accomplished and the results have been spread upon the accompanying charts.

The data from approximately one thousand of our cooperative stations having the longest records, usually from about 10 to 30 years, except in the more newly settled localities of the West where records for shorter periods only are available, have been summarized, and the local conditions due to physical environments brought out in much greater detail than has heretofore been attempted.

These charts, being based upon the results of observations made in the open country and therefore not subject to the artificial conditions prevailing in the large cities where the regular stations of the Bureau are mainly located, differ from any that have appeared in the past in that areas having peculiar climatic features not heretofore shown on such charts are now clearly set forth.

IMPORTANCE OF FROST STATISTICS.

The increasing cost of farm lands, due to the rapid settlement of the country, and the growing demand for foodstuffs from the great centers of population make it necessary that greater returns be obtained from the soil than formerly. This in turn calls for the exercise of more care in the selection of the crops best suited to the several localities and for additional knowledge as to the chief climatic factors in order that the maximum possible return shall be obtained both from the smallest amount of land and with the minimum of effort.

The growing importance of fruit raising in all portions of the country and the tendency toward intensive cultural methods for all crops and the effort made to extend the field of profitable growth of new and important varieties of farm products, necessitate the most careful consideration of the several factors that make for the success or failure of such efforts.

Probably no factor in the study of climate from the standpoint of the agriculturist should be given more consideration than the average length of the growing season. This is the key to an actual knowledge as to the possibilities of success or failure in the production of crops, since in practically all portions of the United States agricultural products are menaced by frost at some period of their growth.

Modern devices for the protection of crops from frost at critical periods have done much and will continue in larger measure to extend the field of profitable culture for many products into regions beyond the natural habitat of the plant; but much loss has been occasioned by efforts to extend such operations into fields which a careful study of the climate would have revealed as

unsuitable on the average for such extension. It may also be assumed that such a study would make it possible to still farther extend the area of profitable cultivation of many classes of products.

CHARTS PREPARED.

The charts presented herewith show graphically:

I. The average date of the last killing frost in spring.
II. The average date of the first killing frost in autumn.
III. The latest date on which a killing frost has occurred in spring.
IV. The earliest date on which a killing frost has occurred in autumn.
V. The average length of the crop growing season, days, being the number of days between the average date of the last killing frost in spring and the average date of the first killing frost in autumn.

Over the districts east of the Rocky Mountains lines have been drawn through approximately identical dates for each 5 or 6 day period for the charts of average dates of killing frost, spring and autumn, but in the two charts of extreme dates the periods cover 10 or 11 days, as the dates were too diverse to admit of a closer approximation.

The chart showing the average length, in days, of the crop growing season was prepared from a somewhat different list of stations than was used for the charts of average dates of frost, hence an actual determination of the length of the season from Charts I and II might differ a few days from the data shown on Chart V.

West of the Rocky Mountains it was not possible, on account of the diversified topography, to draw lines corresponding to those to the eastward, but the actual dates and other data are given for numerous points. Much diversity in these data is apparent and to be expected on account of the varying elevations of the different points of observation and their location with reference to the great mountain masses, the direction of the air drainage, etc.

SPECIAL CONDITIONS AND THEIR INFLUENCE ON FROST FORMATION.

In the elevated mountain districts and on some of the higher plateaus of the western country freezing temperatures are liable to occur in all months of the summer, but their effect on vegetation is not so pronounced as in the districts east of the mountains.

Cool nights are a feature of all arid regions, due to the intense radiation made possible by the generally clear skies and the lack of moisture in the atmosphere. As a result of these conditions the temperature in the early morning hours may frequently reach the freezing point but its continuance may not be for a length of time sufficient to injure the plant structure; in fact, owing to the dryness of the air, frost does not always form with a temperature of 32° or even several degrees lower, and in addition plant life subjected to such variations in temperature becomes more hardy and lower temperatures are required to cause serious injury. On the other hand, in the more humid regions the radiation at night is less rapid, the nights as a rule are not so markedly cold, plant life is less hardy, frost forms readily at the freezing point, the same degree of cold is often protracted over much longer periods of time, and vegetation is therefore more seriously affected.

Throughout the entire mountain and plateau regions there are protected valleys and slopes where the influence of topography on air drainage is sufficient to considerably modify the effect of latitude in the distribution of temperature, and plants and fruits native to localities much farther south may be grown with little fear of injury from frost. There are also localities where on account of the drainage of air from high, snow-covered mountains frosts are more liable to occur than in other localities in the same latitude not so exposed.

Consideration of these points is essential to the successful locating of sites for orchards and gar-

dens in all hilly and mountainous regions, it being possible to find belts on the sides of mountains or high hills where plant growth begins several weeks earlier in the spring than at the tops of the hills or in the valleys below; and likewise in autumn frosts are delayed to the same extent, thus lengthening the crop growing season in these belts several weeks.

The influence of large bodies of water also in tempering the severity of frosts is clearly brought out in these charts, particular attention being invited to the territory surrounding the Great Lakes where at nearby points the length of the frostless season may differ by from 25 to 50 days. Also along the Atlantic Coast in Southern New England, over Long Island and in the vicinity of Chesapeake Bay the growing season is as long as in Tennessee, hundreds of miles to the southward.

Likewise may be seen the increased probability of frost and the consequent shortening of the growing season on the elevated level plateaus, notably in the Berkshire Hills of New England, over the plateau of western New York and north central Pennsylvania, in the Cumberland Plateau and in the highlands of Wisconsin and northern Michigan.

CHART I.—THE AVERAGE DATE OF THE LAST KILLING FROST IN SPI

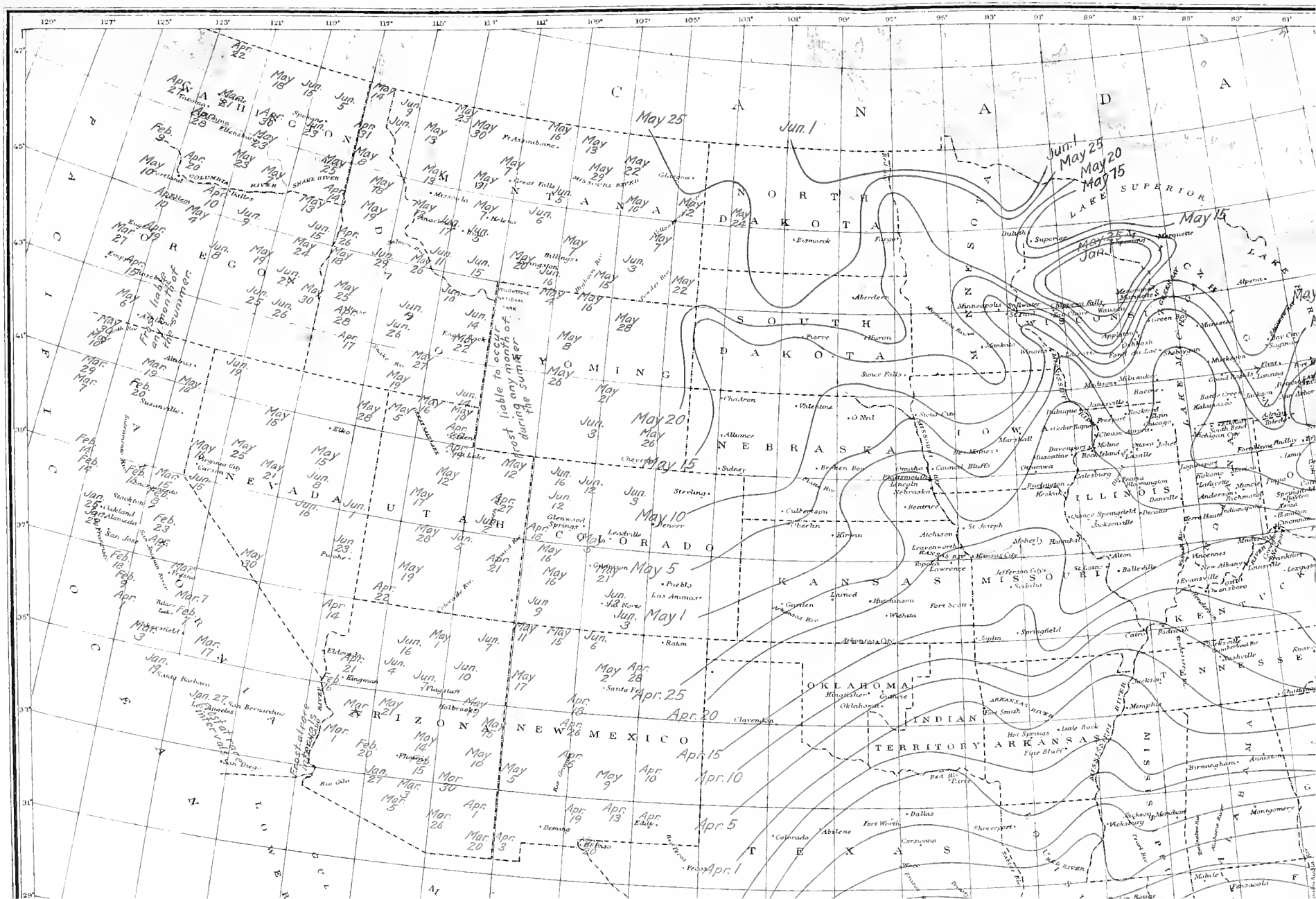

Chart II.—The average date of the first killing frost in A

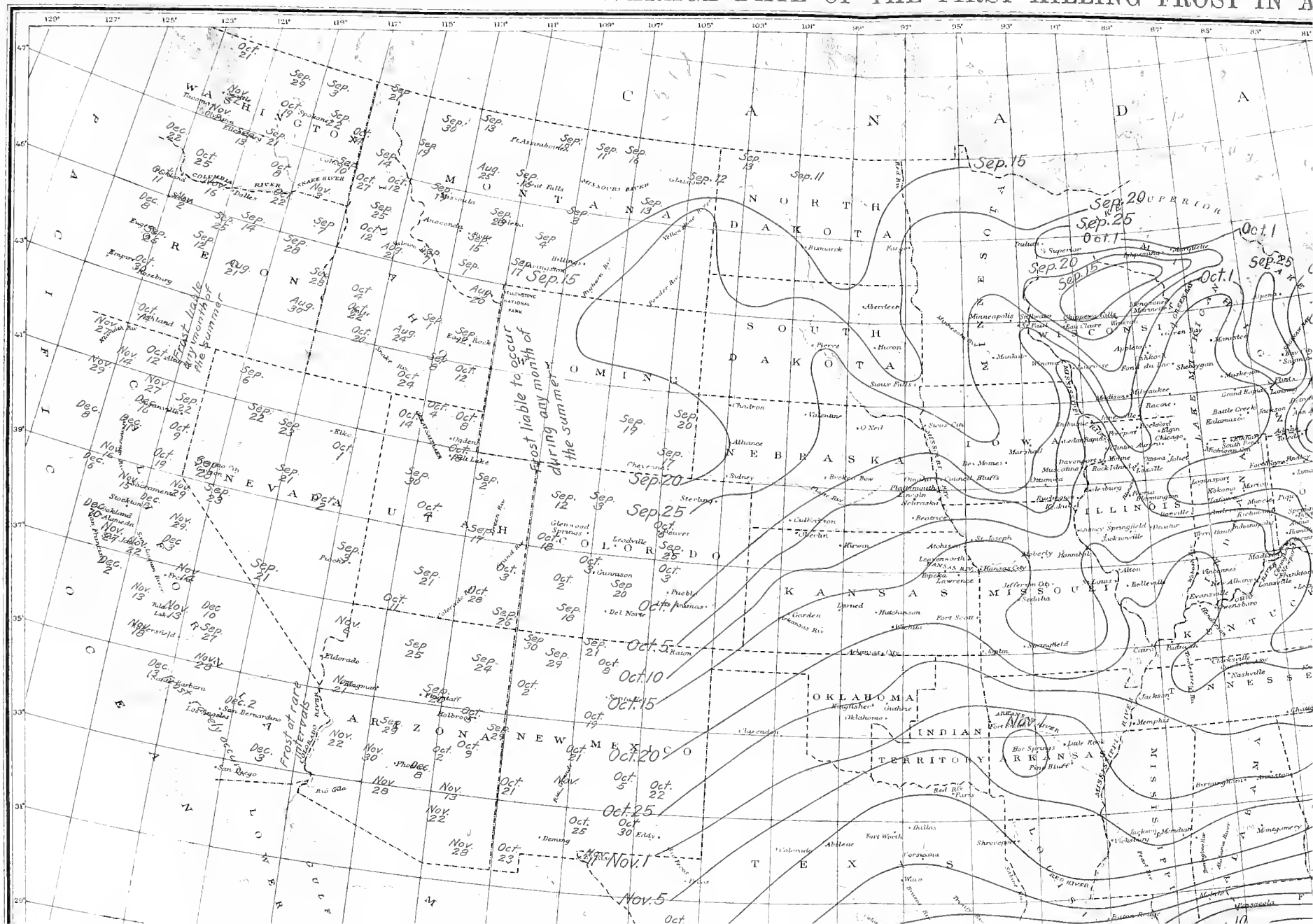

Chart III.—THE LATEST DATE ON WHICH A KILLING FROST HAS OCCURR

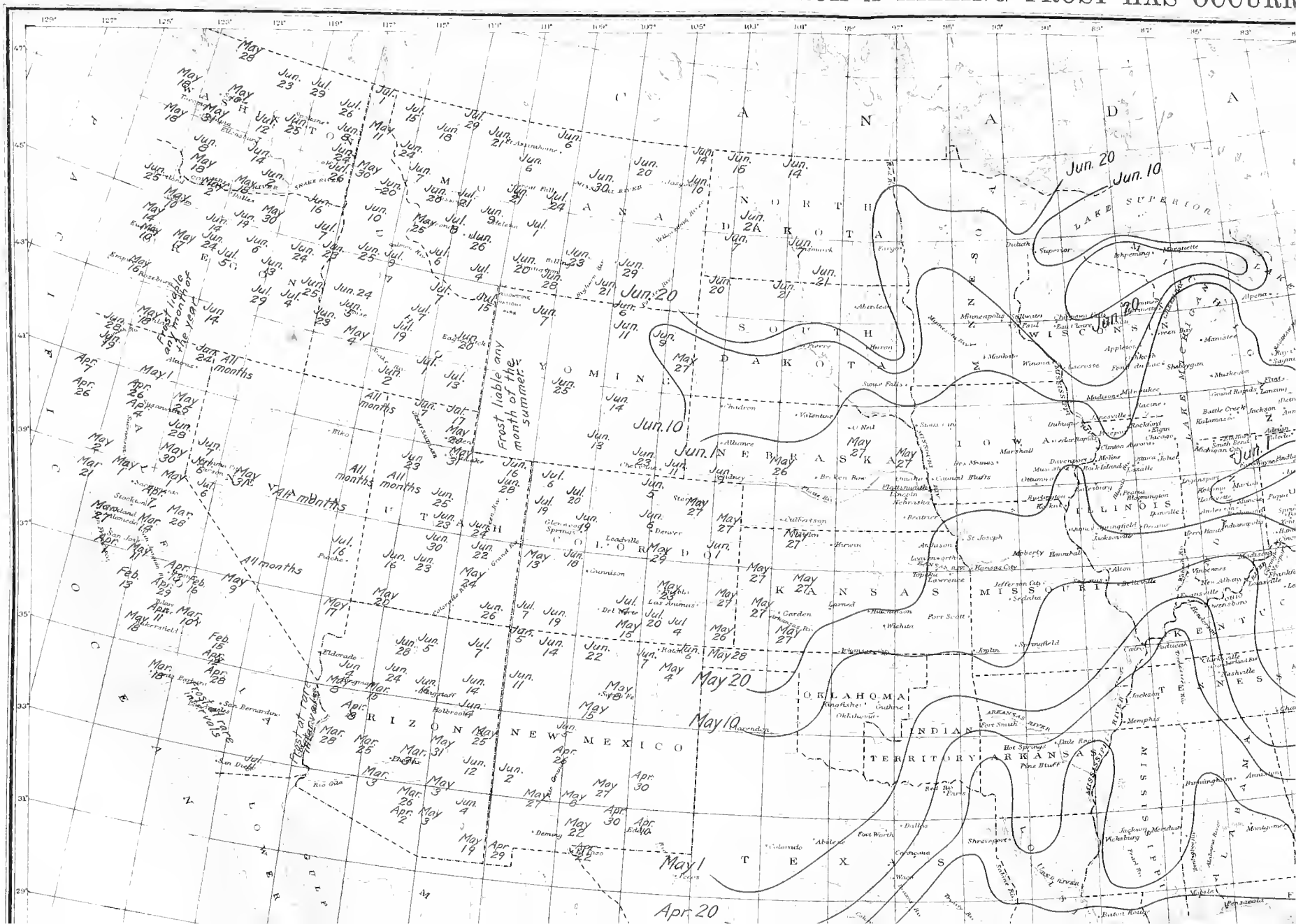

CHART IV.—THE EARLIEST DATE ON WHICH A KILLING FROST HAS OCCURRE

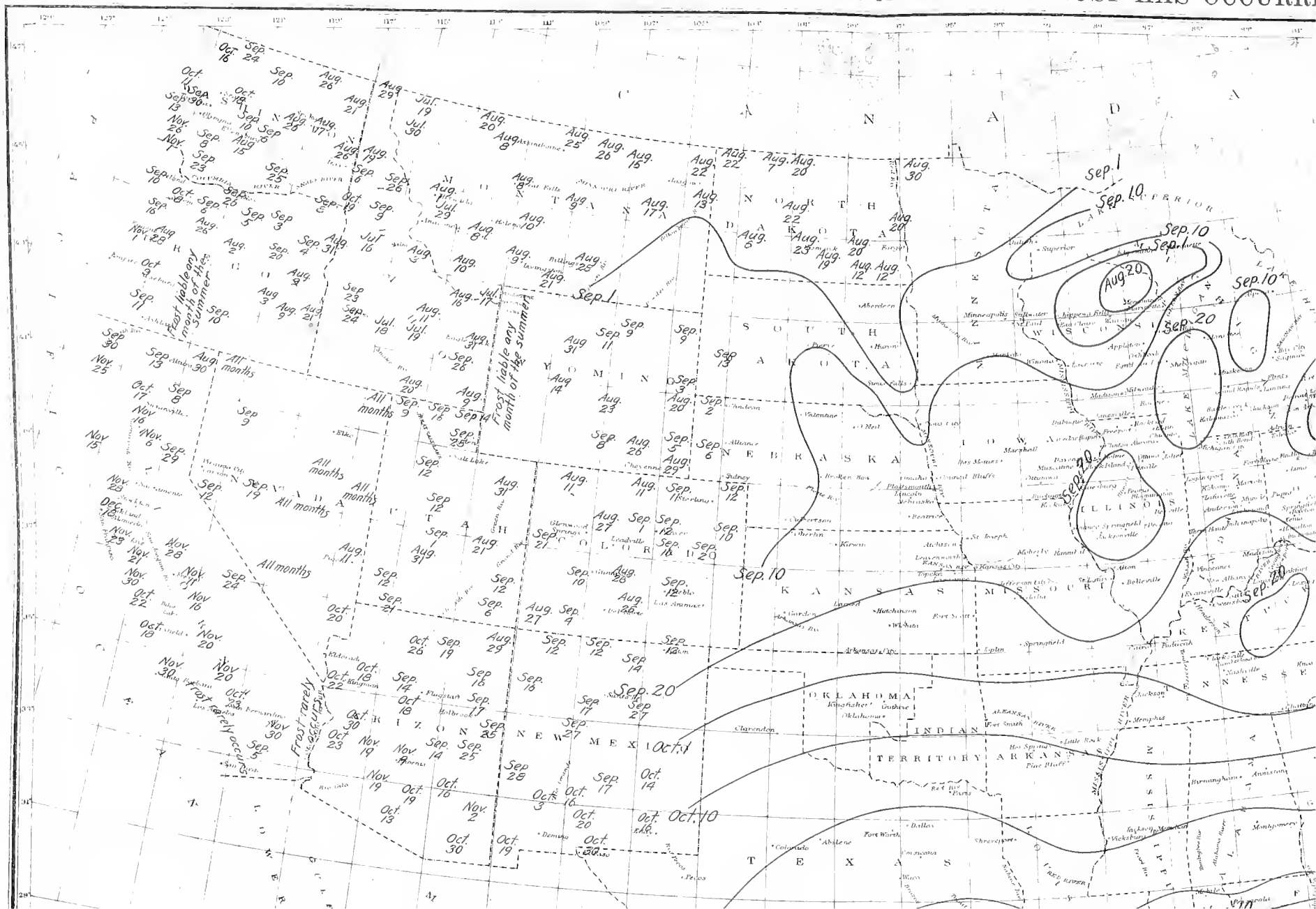

CHART V.—THE AVERAGE LENGTH OF THE CROP-GROWING SEASON,